Appendix A
List of Protein Complexes

Macromolecular complexes

DNA polymerase III is the protein complex responsible for replication of the *E. coli* genome. The complex has high processivity and proofreading activity achieved through the coordinated activity of 10 separate polypeptide subunits. The core of the enzyme is composed of 3 subunits that have polymerase activity and exonuclease activity. This core complex polymerizes 10 to 15 nucleotides per second. Additional protein subunits are added to this core complex for increased performance. The beta subunit is responsible for processivity, and an assembly of 6 proteins composes the clamp-loading complex. This complete complex results in polymerase activity of a rate of 250-1,000 nucleotides per second.

Ribosomes are responsible for translating the genetic code into protein. The *E. coli* ribosome is composed of 3 RNAs and over 50 proteins. This macromolecule interacts with various protein factors to initiate translation, perform peptidyl transferase, translocate tRNAs and mRNAs, and recycle the components. The process is very dynamic with discreet substructures signifying certain events. The binding and release of protein factors relative to ribosome dynamics and catalytic activities is still unclear and difficult to ascertain due to the transient nature of these substructures.

Protein complexes

UvrABC endonuclease is a multiprotein complex responsible for DNA repair in *E. coli*. UvrA dimers bind to uvrB forming a timer that can detect DNA damage. When damage is detected, uvrB binds to the DNA and the uvrA dimer releases. UvrC binds to uvrB and this dimer cleaves DNA upstream and downstream of the damage. UvrC releases and uvrB stays bound while DNA helicase removes the excised DNA and DNA polymerase I fills in the gap. This is completed with DNA ligase covalently attaching the repaired DNA to genome.

Signal transduction

The Hedgehog signaling pathway describes the set of steps required for one aspect of Drosophila embryo development. As the embryo develops a head end and tail end are established as well as body segments where wings, legs, antennae, etc. will develop. This signaling pathway is significant because it is conserved from flies to humans. The cascade of events starts with binding of a ligand or hormone in the extracellular matrix to a membrane protein, which creates a signal. The signal is transduced from the membrane, through the cytoplasm, into the nucleus, where RNA transcription is turned on or off to control expression of specific genes. Briefly, the Hedgehog protein binds to the membrane protein, Patched. Patched normally inhibits

another transmembrane protein, Smothered. When Patched is bound to Hedgehog, Smothered is no longer inhibited. The Hedgehog signaling complex (HSC), comprised of a transcription factor, serine/threonine kinase, kinesin-like molecule and suppressor of the kinase, phosphorylates Smothered in this state. Once phosphorylated, Smothered causes HSC to release the full-length transcription, which enters the nucleus and turns off specific gene expression. Many of these events are very fast and very transient.